Aug. 22, 1939. O. KAISER 2,170,080

CONTROL MEANS FOR VALVES FOR CONCRETE DELIVERY PUMPS

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Fig. 1

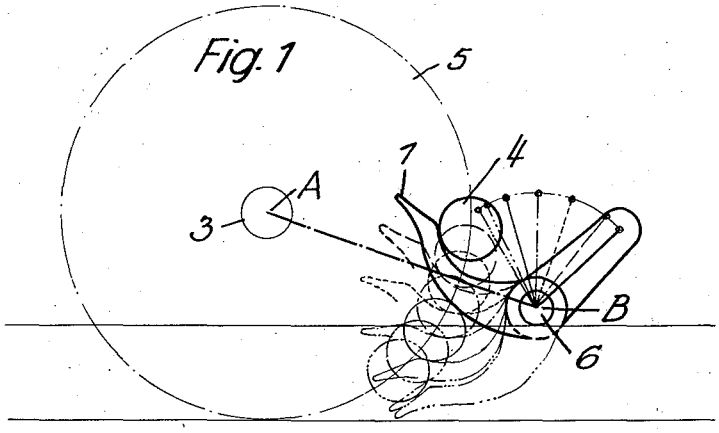

Fig. 2

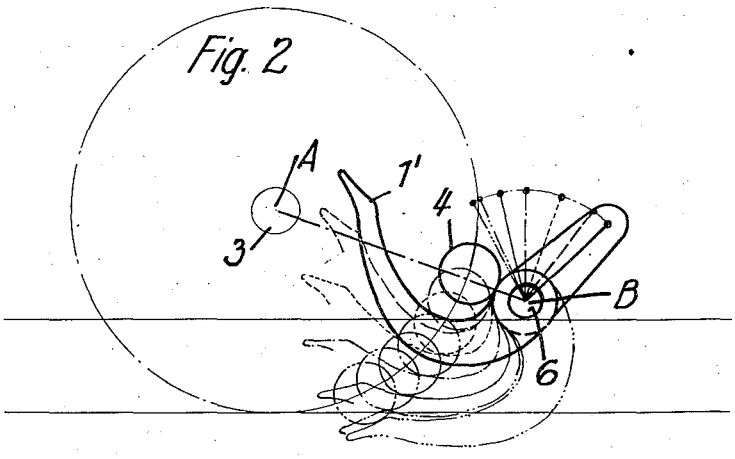

Fig. 3

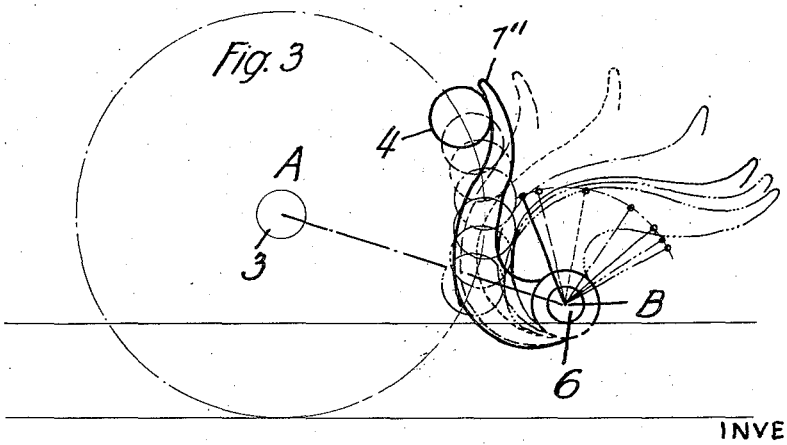

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Fig. 4

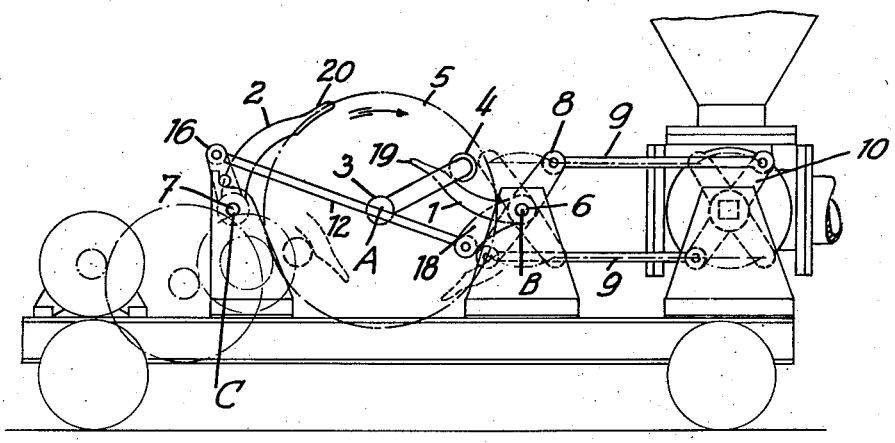

Fig. 5

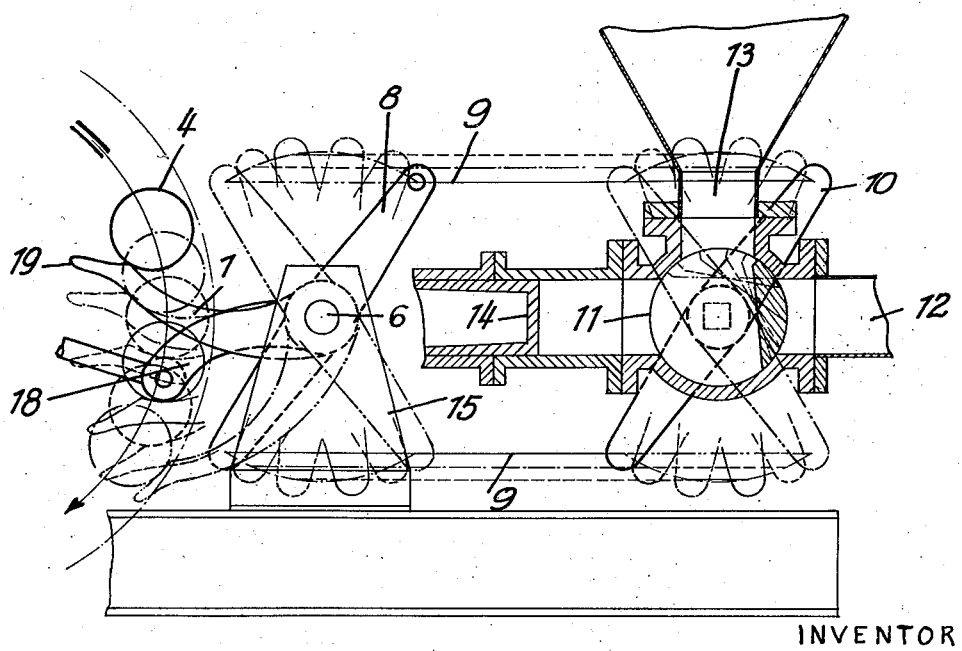

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Fig. 6

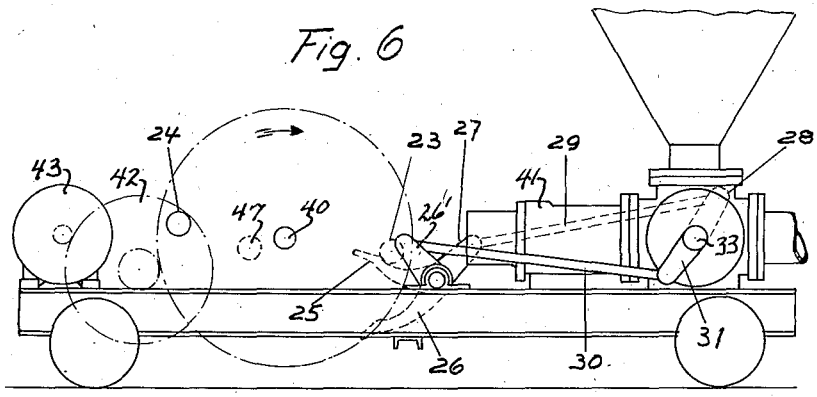


Fig. 7

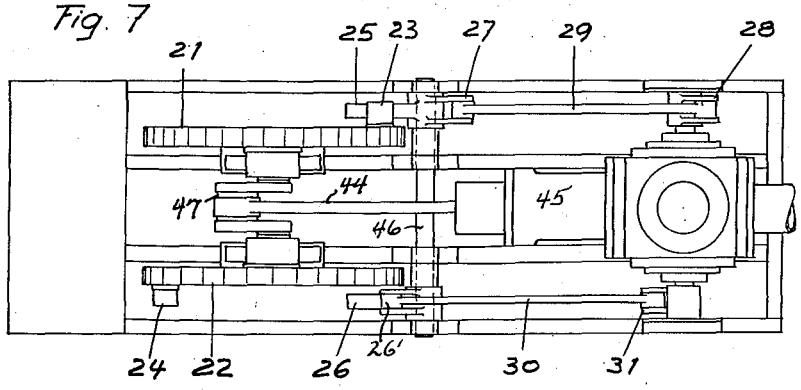
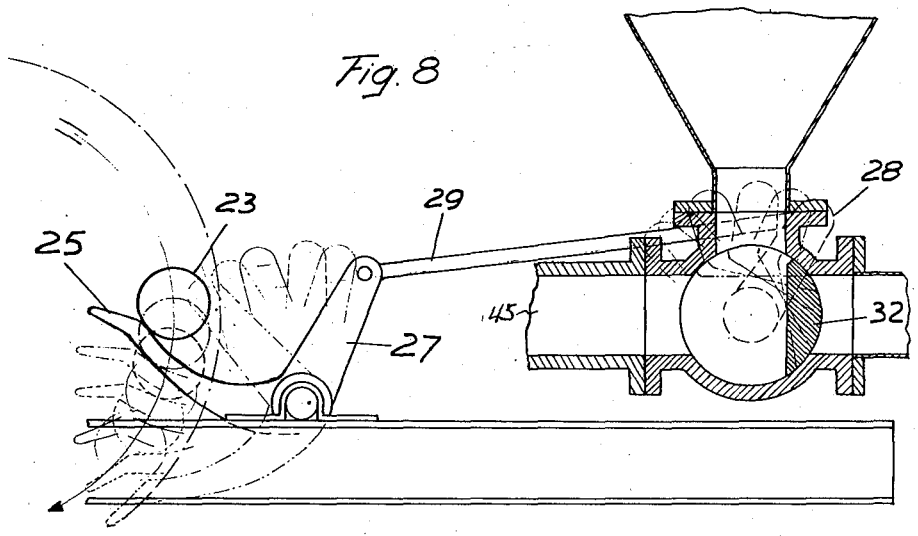


Fig. 8



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Patented Aug. 22, 1939 2,170,080

UNITED STATES PATENT OFFICE

2,170,080

CONTROL MEANS FOR VALVES FOR CONCRETE DELIVERY PUMPS

Otto Kaiser, St. Ingbert, Germany

Application April 2, 1938, Serial No. 199,727
In Germany December 24, 1935

7 Claims. (Cl. 103—227)

This invention relates to improved control means for valves for concrete delivery pumps and particularly for revoluble valves.

A novel feature of the invention consists in the fact that a stop member mounted on a rotating disk runs alternately against a swingable lever effecting the closure of the valve and against a second swingable lever effecting the opening of the valve, the said stop member first approaching the axis of rotation of the particular swing lever and then again receding from said axis and finally leaving the lever at its free end. The two swing levers are so connected that they articulate with each other, for example by a rod. Two driving disks may however be provided each having a stop which acts on two swing levers at 180° to each other.

In the annexed drawings:

Figs. 1 to 3 are diagrams illustrating the relative movements of the swing levers and stops coacting therewith.

Fig. 4 is a diagrammatic elevation of a concrete pump provided with the valve control means of the invention.

Fig. 5 is a diagrammatic vertical sectional view of a part of the pump shown in Fig. 4 but drawn to a larger scale.

Figs. 6 to 8 illustrate a modification of construction of the invention in which:

Fig. 6 is a diagrammatic elevation of the pump,

Fig. 7 is a diagrammatic plan view of Fig. 6, and

Fig. 8 is a vertical section of part of Fig. 6 drawn to a larger scale.

Fig. 1 is merely a diagram serving to explain the force and motion for example on one of the swing levers of which there are two, i. e., the levers 1 and 2 shown in Fig. 4 which can oscillate to and fro on both sides of the connecting straight lines between A and B and A and C respectively, that is from the center of the shaft 3 of the driving disk 5 which carries the abutment 4 and the shafts 7 and 6 (see also Fig. 4) of the swing levers 1 and 2. These elements make it possible to obtain particularly favorable conditions of power and acceleration. According to Fig. 1 the abutment in the form of a roller 4 travels, by rotation of the disk, into contact with the curved swing lever 1 on the side of the latter which is away from the shaft 3 of the driving disk 5 and as a consequence thereof engages with a large amount of leverage. For this reason the acceleration of movement of the curved lever 1 and consequently of the entire rod gear 8, 9 and 10 and of the valve 11 connected to said swing lever by said rod gear is small, while the force exerted on the swing lever 1 is large. Impact effects are avoided in consequence of the tangential contact of the roller 4 into the curve of the swing lever.

In the further movement of the disk 5 and consequently of the roller 4, the effective leverage is reduced inasmuch as it draws near to the pivotal shaft 6 of the curved lever 1 or of the shaft 7 of the curved lever 2 (see Fig. 4). In consequence the acceleration of the curved lever 1 or 2 and of the gear above referred to which is already in motion, is increased. The driving power it is true decreases, but it need no longer be so great since the masses are in motion. This effect continues until, in relation to the curved surface of the curved lever (see Fig. 5), roller 4 has for example assumed its position farthest to the right, that is to say nearest to the shaft 6. At this point the roller 4 to some extent reverses its motion relatively to the running in curve, that is to say it becomes an out running roller and progressively increases the effective leverage and with it the driving force. Mass retardation gradually intervenes and at last, when the roller once more engages with the curved lever with a large effective leverage, brings about such a retardation of the movement that the speed controlled thereby can be braked without danger to the control rod gear. At the moment of the reversal of the stop roller 4 relatively to the curved part the curved lever 4 turns its inner face more and more towards the shaft 3.

Fig. 2 illustrates the case in which the process of contact of the roller 4 with the curved lever 1' takes place entirely on one side thereof, for example below the line A—B. The roller 4 travels through the curved part of the swing lever 1' only in one direction relatively to this curved part, and it therefore does not reverse itself as it does in the arrangement according to Fig. 1. The known control devices for concrete pump valves or for steam valves correspond to the arrangement according to Fig. 2.

An arrangement in which the contact of the roller with the curved lever takes place entirely above the line A—B is shown in the diagram of Fig. 3. The running-in roller 4 passes through the lever curve 1'' only in one direction and first engages with the large leverage, which is however progressively reduced. The reduction of the leverage is continued until the end of the movement.

The two arrangements last described do not operate as advantageously as that according to the invention or according to Fig. 1. The device

according to Fig. 2 shows an unfavorable outward run of the roller on the lever and that according to Fig. 3 an unfavorable inward run of the roller on the curved path of the swing lever operating the control rod gear.

Figs. 4 and 5 illustrate a concrete pump provided with my improved control means for the pump valve and wherein two swing levers and one abutment roller are provided. In this construction, the pump comprises a cylinder 14a having an inlet 13 and an outlet 12 controlled by valve 11. The piston 14 is connected by the usual connecting rod (not shown, but similar to that of Fig. 7) with a crank-pin (not shown) carried by shaft 3.

In Fig. 5, the position of the valve 11 is shown which shuts off the outlet 12 of the pump while still leaving the inlet 13 open, and the position of the pump piston 14 at its crank end makes it clear that the filling of the pump with concrete is terminated. The roller 4 on the driving disk has just reached the curved lever 1 and has just begun to impart to it a movement counter-clockwise, which starts the opening of the discharge outlet 12 of the pump and the closure of the inlet 13. The curved lever 1 is integral with a lever 8 and is rotatable about the shaft 6, which is mounted in the bearing suports 15. By means of the rods 9 and the lever 10 connected to the valve 11, the movement of the lever 1 is transmitted to the valve 11. This movement, which has already been referred to, is produced gradually owing to the tangential contact of the roller 4 into the curve of the lever 1, and as the effective leverage is greatest at the beginning of the movement and the angular speed of the roller 4 remains equal, the rotation of valve 11 is at first at its minimum speed. In proportion, however, as the roller 4 approaches the nearest to the shaft 6, the angular velocity of the lever 8 increases and with it the speed of rotation of the valve, but falls off again in proportion to the subsequent distance of the roller 4 from the shaft 6. When the roller 4 has completed contact with the hollow curve of the lever 1, the valve movement to discharge position has reached its termination, so that when the piston moves toward its head end position it will discharge the concrete from the cylinder. As the piston reaches its head end position, the abutment 4 engages lever 2, as shown in dotted lines in Fig. 4. In exactly the same way the lever 2, as soon as it is engaged by the roller 4 of the driving disk 5, rotates the valve 11 to the position to allow the pump to receive a fresh charge. The lever 16 and the curved lever 2 are also integral and are rotatable about the shaft 7. The rod 12 is articularly connected with the crank 18 and imparts to the rotary valve 11 movement for opening the pump inlet 13 and closing the outlet 12 thereof. As the piston moves towards its crank end position, it will draw in another charge.

In order to take up the momentum of the rotating valve 11 after the completion of its rotation, that is to say to prevent the rotating valve from swinging back from its end position, there are provided on each of the swing levers 1 and 2 straight prolongations 19 and 20 with which the roller 4 remains in contact for a short interval until the valve and its rod gear have come to rest.

In the construction shown in Figs. 6, 7 and 8, the control discs 21 and 22 are shown mounted on the crank-shaft 40 of the pump 41 and may serve as the drive for the pump, being driven through gear 42 by a motor 43. The crank-pin 47 of the crank-shaft is connected by connecting rod 44 to a piston or plunger (not shown) mounted in the pump cylinder 45. The shaft 33 of valve 32 has a crank-arm 28 on one side and a similar arm 31 on the opposite side, as indicated in Figs. 6 and 7. Arm 28 is connected by rod 29 to arm 27 of the swing lever 25 and arm 31 is connected by rod 30 to arm 26′ of swing lever 26. Both of the swing levers are mounted on shaft 46 supported on the pump frame. Disc 21 carries a roller 23 adapted to actuate lever 25 and disc 22 carries a roller 24 adapted to cooperate with lever 26. It will be noted that rollers 23 and 24 are positioned 180° apart, each being adapted to engage and actuate its cooperating lever when the crank is moving through one of its dead centers. For this purpose, the rollers are positioned to engage the cooperating levers prior to the crank reaching dead center and to disengage therefrom after the crank has passed dead center.

The inlet port is open in Fig. 8. For closing it by rotating valve 32 through 90° counter-clockwise from the position shown, the roller 23 rotates lever 25 counterclockwise. Rod 29 transmits movement to valve 32. This opens the delivery port, and the piston or plunger moving to the right expels the concrete. (The drawing does not show this position.) Simultaneously, the other lever 26 on the other side of the pump is shifted by lever 31, rod 30 and lever 26′, to bring it into a position so that after a half revolution of the crank shaft the roller 24 will engage and actuate the lever 26, pushing it down. This rotates the valve 32 another 90° clockwise to a position closing the outlet port and opening the inlet, as shown. The valve movement occurs while the crank is moving through the dead center, with the plunger hardly moving at all. The valve starts slowly from rest, then accelerates, and then slows down again.

What I claim as my invention and desire to secure by Letters Patent of the United States is—

1. In a concrete delivery pump having a cylinder, a piston, a pump shaft, means on the shaft for reciprocating the piston, an intake, a discharge and an oscillating valve for selectively placing the intake and discharge in communication with the pump cylinder, a control device for said valve comprising a rotary driving disk, an abutment member mounted on the face of said disk adjacent the periphery thereof, a curved swingable lever rotatably mounted and projecting into the path of said abutment member whereby the lever makes contact during a period of rotation of the disk and thereby effects a movement of said curved lever during said period, a second swingable curved lever rotatably mounted and projecting into the path of said abutment to make contact therewith during a period of rotation of the disk intermittent of said first mentioned period to impart angular movement to said second swingable lever, rod mechanism operated by the angular movement of said first-mentioned curved lever and connected to said valve to shift the same to one position, and lever mechanism operated by the angular movement of said second-mentioned swingable lever and connected to said first-mentioned lever and the rod mechanism to shift said valve to another position during the angular movement of said second-mentioned swingable lever.

2. A control device according to claim 1, in which the abutment member during rotation of

the disk runs inwards and outwards on the respective curved swingable levers tangentially with relation to the curvature of said levers.

3. In a concrete delivery pump having a cylinder, a piston, a pump shaft, means on the shaft for reciprocating the piston, an intake, a discharge and an oscillating valve for selectively placing the intake and discharge in communication with the pump cylinder, a control device for said valve comprising a rotary driving disk having an abutment member thereon to rotate therewith, a pair of curved levers each rotatably mounted and projecting into the path of said abutment member so that the levers will contact the abutment member intermittently during a period of complete rotation of the disk, means for connecting one of the levers with the valve, and means for interconnecting the other lever with the lever just mentioned, said levers having curved surfaces which contact with the abutment member and operating the valve at different speeds between the opening and closing thereof and one lever opening the valve and the other closing the valve.

4. In a pump for delivery of concrete, a rotary valve, means controlling said valve comprising a rotary driving disk, an abutment member mounted on the face of said disk adjacent the periphery thereof, a curved swingable lever rotatably mounted and projecting into the path of said abutment member whereby the lever makes contact therewith during a period of rotation of the disk and effects during said period a movement of said lever beyond the line connecting the bearing center of said lever and the bearing center of said driving disk, said lever swinging backwards and forwards about said center line, a second swingable curved lever rotatably mounted and projecting into the path of said abutment to make contact therewith during a period of rotation of the disk intermittent of said first-mentioned period to impart to said second swingable lever an angular movement similar to that of the first-mentioned swingable lever, and rod mechanism interconnecting said levers and valve adapted to shift the valve to intake position when one lever is engaged by the abutment and to shift the valve to discharge position when the other lever is engaged by the abutment.

5. In a concrete delivery pump having a cylinder, a piston, a pump shaft, means on the shaft for reciprocating the piston, an intake, a discharge and an oscillating valve for selectively placing the intake and discharge in communication with the pump cylinder, a control device for said valve comprising a rotary driving disk means, abutment means carried by said disk means adjacent the periphery thereof, a curved swingable lever rotatably mounted and projecting into the path of said abutment means whereby the lever makes contact during a period of rotation of the disk and thereby effects a movement of said curved lever during said period, a second swingable curved lever rotatably mounted and projecting into the path of said abutment means to make contact therewith during a period of rotation of the disk intermittent of said first-mentioned period to impart angular movement to said second swingable lever, rod mechanism operated by the angular movement of said first-mentioned curved lever and connected to said valve to shift the same to one position, and lever mechanism operated by the angular movement of said second-mentioned swingable lever and connected to said first-mentioned lever and the rod mechanism to shift said valve to another position during the angular movement of said second-mentioned swingable lever.

6. In a concrete delivery pump having a cylinder, a piston, a pump shaft, means on the shaft for reciprocating the piston, an intake, a discharge and an oscillating valve for selectively placing the intake and discharge in communication with the pump cylinder, a rotary valve, means for controlling said valve comprising a rotary driving disk on said pump shaft, an abutment member mounted on the face of said disk adjacent the periphery thereof, a curved swingable lever rotatably mounted and projecting into the path of said abutment member whereby the lever makes contact therewith during a period of rotation of the disk and effects during said period a movement of said lever beyond the line connecting the bearing center of said lever and the bearing center of said driving disk, said lever swinging backwards and forwards about said center line, a second disk on said pump shaft, an abutment on said second disk, a second swingable curved lever rotatably mounted and projecting into the path of said second abutment to make contact therewith during a period of rotation of the disk intermittent of said first-mentioned period to impart to said second swingable lever an angular movement similar to that of the first-mentioned swingable lever, and rod mechanism interconnecting said levers and valve adapted to shift the valve to intake position when one lever is engaged by its abutment and to shift the valve to discharge position when the other lever is engaged by its abutment.

7. In a concrete delivery pump having a cylinder, a piston, a pump shaft, means on the shaft for reciprocating the piston, an intake, a discharge and an oscillating valve for selectively placing the intake and discharge in communication with the pump cylinder, a control device for said valve comprising rotary driving disk means having abutment means thereon mounted to rotate with the disk means, lever means rotatably mounted and projecting into the path of the abutment means so that during a period of a complete rotation of the disk means the abutment means will contact the lever means to effect a movement of the lever means during said period, and means connecting the lever means with the valve in order to operate the valve on actuation of the lever means by the abutment means for opening and closing said valve during said period, said lever means having curved surface means which contact with the abutment means in order to operate the valve at different speeds between the opening and the closing thereof.

OTTO KAISER.